Declassified in Part - Sanitized Copy Approved for Release 2011/12/28 : CIA-RDP78-03300A001600020111-8

1-101 file

CONFIDENTIAL

Research Order #1
Phase I - Progress Report #3

9 March 1954

5 COPIES DISTRIBUTED AS FOLLOWS:

3 copies to:

25X1

1 copy to:

1 copy to:

25X1

CONFIDENTIAL

A-3097

Declassified in Part - Sanitized Copy Approved for Release 2011/12/28 : CIA-RDP78-03300A001600020111-8

Declassified in Part - Sanitized Copy Approved for Release 2011/12/28 : CIA-RDP78-03300A001600020111-8

CONFIDENTIAL

Research Order #1 9 March 1954
Phase I - Progress Report #3

OBJECTIVE:

To study and evaluate the factors and components involved in the design of a portable infrared communicator.

GENERAL DATA:

The work to be performed according to Bid Proposal #76-1, Phase I, may be summarized as follows:

A. Evaluation of sources and sensitive elements

B. Determination of beam width requirements and evaluation of "find-operate" systems

C. Study of modulation methods and attendant optical systems

D. Evaluation of power sources

E. Study of required circuit characteristics

The results of these studies will be used as the basis for recommending a system to be developed.

DETAILED DATA:

A. Evaluation of sources and sensitive elements

The influence of various combinations of sources and sensitive elements on the general form and performance of the complete communicator was studied. Several combinations were immediately eliminated from further consideration. The following preliminary assumptions were made:

CONFIDENTIAL

Declassified in Part - Sanitized Copy Approved for Release 2011/12/28 : CIA-RDP78-03300A001600020111-8

Declassified in Part - Sanitized Copy Approved for Release 2011/12/28 : CIA-RDP78-03300A001600020111-8

CONFIDENTIAL

1. Transmitter beam width about 1^{o}

2. Receiver beam width about $.25^{o}$

3. Equipment size and weight as detailed in Progress Report #1

Because of the large size of its arc, the cesium lamp would require a long focus objective to give the required beam width. To maintain a suitably high focal ratio would, therefore, require a much larger objective than could be used in compact equipment without resorting to folding. The optical problems involved in the large arc would make it impractical to modulate mechanically; thus, an audio power output sufficient to modulate the arc electrically must be provided. The arc must operate on d. c. or ultra-sonic power, and requires high-voltage starting and some degree of ballasting. The power and weight added by these electrical and optical requirements would have to be minimized by a large reduction in the power input to the arc. The smallest available lamp (16 w) is still far too large to be used in the communicator.

In order to obtain the above assumed ratio of receiver beam width to transmitter beam width using a common objective, the sensitive area of the detector must be about one-fourth the active area of the source. For this reason the thalofide cell and the photomultiplier are properly used with large sources such as the cesium lamp or gas mantle. Neither of these detectors has any desirable optical, electrical, or mechanical features not found in other types when used in conjunction with small sources; and consequently, their use is no longer being seriously considered.

The xenon lamp has high brightness, a small source, and good life. Because of their high operating pressure (20 to 60 atmospheres), the lamps are extremely difficult to restart when hot and also constitute a considerable hazard to personnel and equipment. They require high-voltage r.f. for starting and a ballasted d. c. operating supply. The circuit complexity and starting problems more than offset the advantages in greater luminous efficiency and brightness, and therefore, these lamps will not be investigated further.

CONFIDENTIAL

Declassified in Part - Sanitized Copy Approved for Release 2011/12/28 : CIA-RDP78-03300A001600020111-8

Declassified in Part - Sanitized Copy Approved for Release 2011/12/28 : CIA-RDP78-03300A001600020111-8

 CONFIDENTIAL

Sources still under consideration are tungsten filament lamps and the zirconium arc. Tests to determine optimum source-detector combinations will be made using one or both of these sources.

The optical range attenuator has been completed, and will shortly be installed on the overhead door in the dark tunnel. The air conditioner has been on hand for several weeks, but a plumbers' strike has held up its installation. Work on the ventilating system is now going forward, and we expect to be moved into the dark room in time to obtain some data for inclusion in the next report.

B. Determination of beam width requirements and evaluation of "find-operate" systems

All of the test equipment necessary to evaluate the beam width requirements is now on hand. Two 24 watt high-fidelity amplifiers will be used to modulate the lamps in the transceiver simulators and to amplify the received signal. For these tests it will be assumed that the location of the communicators will be known to within $\pm 5^{\circ}$ in elevation and azimuth, and the minimum "find" beam width will be determined on this basis.

C. Study of modulation methods and attendant optical systems

The choice of modulation method will be determined when the source is selected, but the latter selection is influenced, of course, by the feasibility of modulating. Large sources are not easily modulated by mechanical means, since motion of a relatively large optical surface is required. Electrical modulation is reasonable only if the modulation percentage is high and the total power required for operation of the source and modulator is at least no greater than that required with other systems. Small sources are relatively easy to modulate by mechanical means; but below a certain size mechanical modulation becomes difficult again, because in order to maintain

CONFIDENTIAL

Declassified in Part - Sanitized Copy Approved for Release 2011/12/28 : CIA-RDP78-03300A001600020111-8

Declassified in Part - Sanitized Copy Approved for Release 2011/12/28 : CIA-RDP78-03300A001600020111-8

 CONFIDENTIAL

a specified beam width, the focal ratio must be decreased, and the wide angles that the optical system must therefore handle, present nearly as bad problems as those involved in the use of a large source.

D. Evaluation of power sources

In order to get a comparison between power sources, the total power requirement is estimated to be 75 watts and the operating time 10 hours.

The most efficient available battery is the Yardney Silvercell type HR100. Five of these cells would be required, resulting in a total weight of 13.5 lbs. and a volume of 230 cu. in. exclusive of case. Any high voltage would have to be obtained from a vibrator supply, and the weight and volume of the vibrator and transformer must be added. Since vibrators operate best at lower frequencies, the weight of the supply might be several pounds.

During the period covered by this report, exploratory letters were sent to 11 manufacturers, requesting information on miniature permanent-magnet alternators currently available or capable of being developed shortly. On the basis of the answers received, the Motoresearch Company, of Racine, Wis., was visited and the problem discussed with them in considerable detail. Motoresearch feels that within 90 to 120 days they could develop an alternator to the following specifications:

1. Mechanical input: 90 watts at 12,000 rpm
2. Electrical output: 75 watts at 800 cps
3. Weight: 1.5 pounds
4. Volume: 5 - 10 cu. in.

This size estimate takes into consideration the possible requirement of a 600 V (C. T.) winding, and a 6.3 V winding. Their guess was that the cost of development and hand fabrication of two units would be under $2,000. They will submit a firm bid when they are given sufficient specifications to determine a design.

CONFIDENTIAL

Declassified in Part - Sanitized Copy Approved for Release 2011/12/28 : CIA-RDP78-03300A001600020111-8

Declassified in Part - Sanitized Copy Approved for Release 2011/12/28 : CIA-RDP78-03300A001600020111-8

CONFIDENTIAL

Research Order #1
Phase I - Progress Report #3

9 March 54

During this period a competent-sounding letter was received from McCoy Products Company, of Culver City, Calif., in response to our inquiry on model airplane engines. Representatives of the company were in Chicago for the Model Industry Trade Show, and a conference was arranged with one of their engineers. The following information was brought out in the discussion:

1. Model airplane engines can be designed to operate on a wide variety of fuels. In model airplane service starting is a prime consideration (because the propeller can be flipped only about one revolution each time), and fuels are normally formulated to obtain best starting consistent with maximum power. For our use an engine could be made to operate satisfactorily from ordinary gasoline and motor oil.

2. The currently popular ignition system uses a "glow-plug". The plug contains a platinum filament heated on starting by a dry cell and while operating by the compression of the fuel mixture. A plug suitable for use with gasoline-oil fuel could be made to have adequate life (20 hours or more).

3. The life of the engines is determined by wear of the crankshaft bearing and piston-sleeve units. These may be expected to give at least 100 hours service under reasonable operating conditions. The engines can easily be cooled to a point where their life is not limited by excessive heating.

4. It is a simple matter to effect a great reduction in the exhaust noise of the engines. If it is possible to sacrifice a considerable percentage of the output of the engine, the noise output can probably be reduced to a negligible level.

CONFIDENTIAL

Declassified in Part - Sanitized Copy Approved for Release 2011/12/28 : CIA-RDP78-03300A001600020111-8

Declassified in Part - Sanitized Copy Approved for Release 2011/12/28 : CIA-RDP78-03300A001600020111-8

Research Order #1 CONFIDENTIAL 9 March 54
Phase I - Progress Report #3

5. The McCoy .195" engine produces .40 H.P. at 12,500 rpm. It weighs .25 lbs. and uses about .5 lb. of fuel per hour.

An order has been placed with McCoy for four engines, one of which will be silenced by them to a point where it can be operated in the laboratory. Delivery of the order should be made within a week or two.

On the basis of the information supplied by Motoresearch and McCoy, it is estimated that a 75 watt engine-generator unit would have a dry weight of 3 lbs. and a volume of 100 cu. in. It would require 5 lbs. of fuel and one "D" cell to operate for 10 hours.

E. <u>Study of required circuit characteristics</u>

This study will be undertaken when optical system, detector, and modulator requirements are known better.

PROGRAM FOR NEXT INTERVAL:

Darkroom tests to determine beam width requirements will be made. If possible, a choice between tungsten and the zirconium arc will be made so that power requirements can be estimated and a suitable alternator ordered. If there is time, tests of the optical effects of several mechanical modulating schemes will be made.

Report prepared by 25X1

Report approved by

Report approved by

CONFIDENTIAL

CWS/t

Declassified in Part - Sanitized Copy Approved for Release 2011/12/28 : CIA-RDP78-03300A001600020111-8